

Original article:

Analysis of the Risk Factors, Presentation and Predictors of Outcome in Patients Presenting with Diabetic Foot Ulcers at Tertiary Care Hospital in Karnataka

Sarita Kanth

Associate Professor, Department of General Surgery, Kasturba Medical College, Manipal Karnataka, India.

Corresponding Author: Dr. Sarita Kanth, Associate Professor, Department of General Surgery, Kasturba Medical College, Manipal Karnataka, India.

Date of submission: 08 September 2009, Date of acceptance: 22 October 2009

Abstract

Introduction: The aim of study was detailed analysis of the presentation of diabetic foot ulcers, characteristics and predictors of outcome (incidence of amputation in neuropathic, ischemic, neuro ischemic) in patients presenting with diabetic foot at hospital in Manipal, Karnataka.

Materials and Methods: Total 120 patients of age 24 years and above with diabetic foot complications were included in the study. Diabetic patients presenting with foot ulcers were enrolled in this study. All of them were admitted in the hospital. History was taken with special emphasis on the treatment given, appearance of the wound and ulceration.

Result: Total 120 patients admitted with the complicated diabetic foot ulcers and non healing chronic diabetic foot wounds. Out of these 88 patients (73.3%) were male and 32 (26.7%) female.

Conclusion: Ulcer healing is heavily influenced by the quality of the provided care and the adherence to it by the patients.

Keywords: Diabetic Foot Ulcers, Amputation, Neuropathic, Ischemic, Neuro Ischemic.

INTRODUCTION

foot ulceration is affecting 15% or more of people with DM at some time in their lives.¹ According to Hunt's study,² the prevalence of foot ulcers ranges from 4 to 10 percent among patients with diabetes, and the lifetime incidence is estimated to be 10 to 25 percent. At present, the standard therapy for diabetic foot ulcers includes glucose control, management of infection, debridement, offloading high pressure, and use of dressings. However, the treatment outcomes are far from satisfaction, whatever the efficacy or the complications.³

Neuropathy, a serious complication of diabetes, can lead to Charcot changes in the foot. These disrupt the joint stability and the architecture of the foot. There is increased pressure under the sole of the foot with prominence of the metatarsal heads. This leads to ulceration. There is progression from superficial infection to deep and then abscess formation and osteomyelitis. Ulceration, infection, and gangrene of foot are the leading causes of hospitalisation in patients with diabetes mellitus.^{4,5} Diabetic foot ulcers are a complex problem that leads to foot infection, necrosis and most of the time results in major amputation. Other most common complications include boil, carbuncle, necrotizing fasciitis and gangrene of the foot. Approximately 3–4% of individuals with diabetes

have foot ulcers or deep infections and 15% develop foot ulcers during their lifetime. The risk of lower extremity amputation increases by a factor of 8 once an ulcer develops. At 2 years following transtibial amputation, mortality rate is 36%.The primary goal in the treatment of diabetic foot ulcers is to obtain wound closure. Management of the foot ulcer is largely determined by its severity (grade) and vascularity, and the presence of infection.^{6,7}

A careful physical examination, monofilament testing for neuropathy, trans-coetaneous oxygen mapping, distal Doppler pressure measurements, Doppler flow studies and lower extremity blood pressure measurements should be done to determine the safe amputation level. The goal of examination and assessment is to determine preoperatively which site may be chosen for amputation with fair certainty that healing will follow. A multidisciplinary approach should be employed because of the multifaceted nature of foot ulcers and the numerous co-morbidities that can occur in these patients.^{7,8}The aim of study was detailed analysis of the presentation of diabetic foot ulcers, characteristics and predictors of outcome (incidence of amputation in neuropathic, ischemic, neuro ischemic) in patients presenting with diabetic foot at hospital in Manipal,Karnataka.

MATERIALS AND METHODS

This prospective observational study was done in department of general surgery, at hospital in Karnataka. Total 120 patients of age 24 years and above with diabetic foot complications were included in the study.

Diabetic patients presenting with foot ulcers were enrolled in this study. All of them were admitted in the hospital. History was taken with special emphasis on the treatment given, appearance of the wound and ulceration. A detailed examination was carried out to exclude other medical complications of diabetes mellitus. Then the foot was examined for areas of ulceration and gangrene. The colour of limb, skin, nail, hair or any atrophic changes were noted. A standard neurological examination was performed testing the sensation to light touch (cotton-wool), pain (neurological examination pins), vibration (128 Hz tuning fork), and tendon reflexes at the ankle. Peripheral neuropathy was considered to be present, if three of the four sensations were absent. The state of circulation was checked by palpating dorsalispaedis and posterior tibial artery followed by Doppler study. All the patients were admitted through emergency department. After admission all the data were recorded on predesigned pro forma and consent were taken for study. All the routine investigations like complete blood count, chemistry, coagulation profile, arterial blood gases, chest x-ray and X-ray of foot were also done to see the soft tissue and bony status of foot. Empirically broad spectrum intravenous antibiotics started after sending wound swab for culture and sensitivity. Most of the patients under went primary debridement of foot ulcer and removal of dead tissue.

Demographics of patients including age, sex, along with ulcer size, type, site, duration and type of diabetes and Grade according to Wagner Classification were recorded. Dressing was done three times in a day first wash with normal saline than thick layer of honey applied and sterile dressing done. Patients were followed over period, once wound healed completely or a lower limb amputation performed, the outcome noted and patient was deemed to have completed study.

RESULTS

Total 120 patients admitted with the complicated diabetic foot ulcers and non healing chronic diabetic foot wounds. Out of these 88 patients (73.3%) were male and 32 (26.7%) female. the percentage and number of socio demographic profile of patients and type or site of ulcer were shown in table 1.(Figure 1,2,3)Below knee amputation

was done in one patients and big toe amputation in three patients. The wounds in all other cases healed well. Primary closure was achieved in 17 patients while split thickness skin grafts were used in 28 patients. Surgical outcomes were shown in table 2 and Organism isolated from the ulcer was shown in table 3 and figure 4. The ulcers and wounds took an average of 5 weeks to heal completely.

Table 1: Socio-demographic data (n=120)

| Variable | Number | Percentage |
|---------------------------------------|---------------|-------------------|
| Sex | | |
| Male | 88 | 73.3% |
| Female | 32 | 26.7% |
| Age | | |
| 25-45 | 46 | 38.3% |
| 46-65 | 62 | 51.7% |
| 66-77 | 12 | 10% |
| Size of Ulcer (cm²) | 5.54±8.3 | - |
| Type of Ulcer | | |
| Neuropathic | 19 | 15.8% |
| Neuro-ischemic | 72 | 60% |
| Ischemic | 29 | 24.2% |
| Site of Ulcer | | |
| Dorsum of foot | 61 | 50.8% |
| Inter-digitations | 7 | 5.8 |
| Big toe | 34 | 28.3 |
| Planter area | 4 | 3.3 |

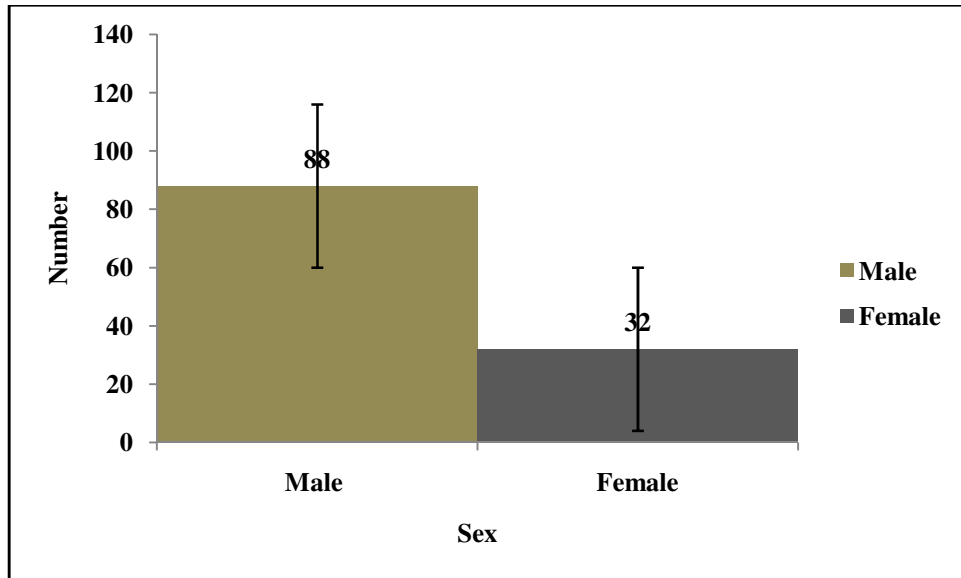


Figure 1: Sex distribution

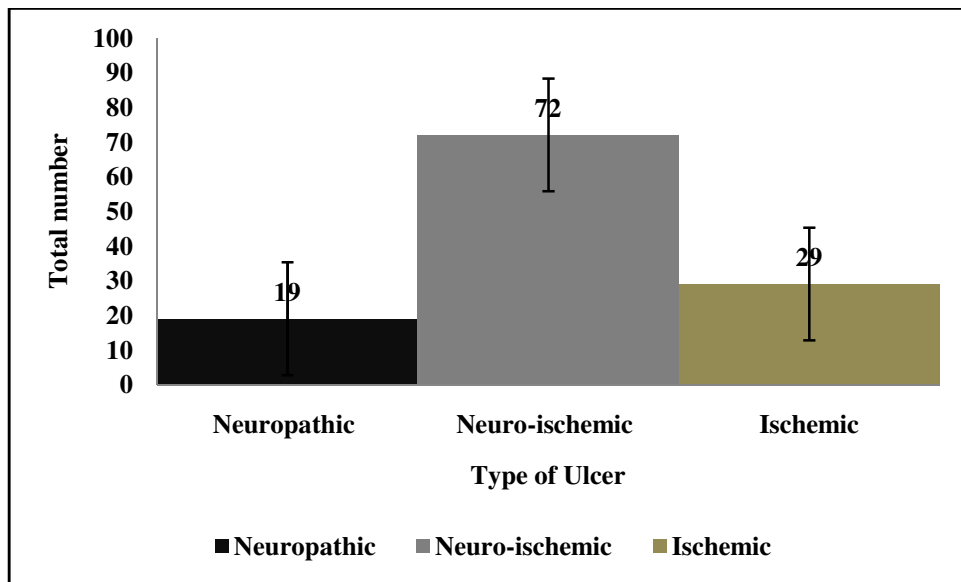


Figure 2: Ulceration type

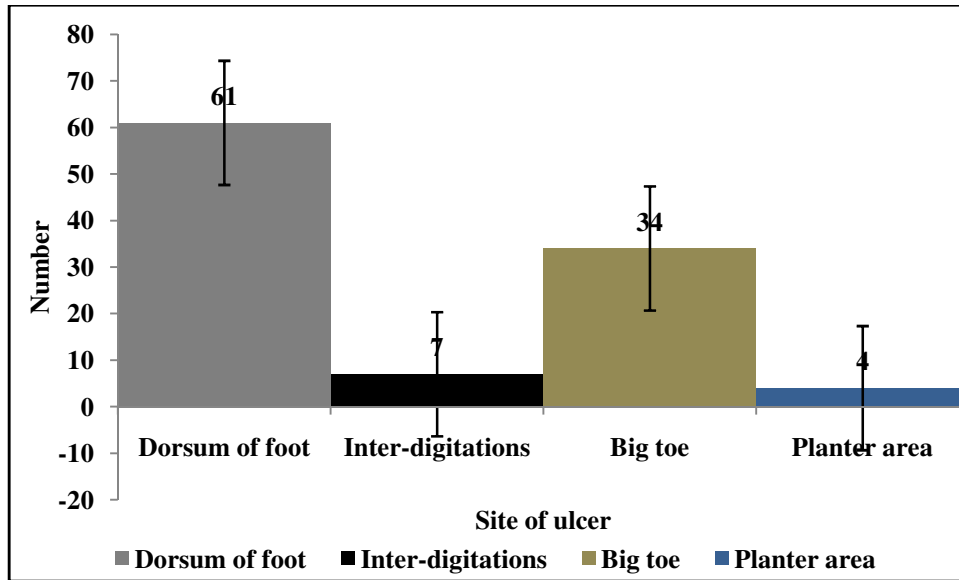


Figure 3: Type of Ulcer

Table 2: Surgical outcome

| Features and Variable | Number | Percentage |
|-------------------------------|--------|------------|
| Level of Amputation | | |
| Big toe | 3 | 2.5% |
| Below knee | 1 | 0.8% |
| Type of Anesthesia | | |
| General Anesthesia | 52 | 43.3% |
| (Spinal, Lumbar, Ankle Block) | 68 | 56% |

Table 3: Organisms isolated from ulcers

| Organism | Frequency | Percentage |
|-----------------------|-----------|------------|
| Staphylococc | 44 | 36.7% |
| Proteus | 36 | 30% |
| E. Coli | 16 | 13.3% |
| Klebsiella | 9 | 7.5% |
| No growth of organism | 15 | 12.5% |

DISCUSSION

Approximately 15–20% of the estimated 16 million persons in the United States with diabetes mellitus will be hospitalised with a foot complication at sometime during the course of their disease.⁸ Diabetes is a modern day worldwide epidemic and diabetic foot complications are responsible for more than 50% of major limb

complications. In our study 25% of patients had amputation including below knee, fore foot ray etc. The annual incidence of foot ulceration is slightly more than 2% among all patients with diabetes and between 5–7.5% among diabetics with peripheral neuropathy. Peripheral neuropathy results in loss of protective sensations of pain and in autonomic dysfunction with sympathetic denervation, dry skin and warm feet. In 22.6% of study patients had neuropathy as the underlying cause of ulceration. Appropriate medical education regarding early assessment of lesion or warning signs of imminent ulceration in patients with sensory loss is essential.

Duration of diabetes and poor control are known risk factors for diabetic foot ulcers⁹ as shown by Lipsky and Sheehan.¹⁰ In our study most of the patients were poorly controlled. Many other studies from developing countries have reported similarly.¹¹⁻¹³

Risk of amputations is more than 15–46 times higher in diabetics than in non diabetics.¹⁴ One of the single most common cause of hospitalization is foot ulcers and in diabetic patients lower extremity amputation.¹⁵ Complications of foot in diabetic patients are very difficult to treat and more expensive.¹⁶

Treatment of ulcers of the hind foot and ankle may be extremely difficult. Marked instability and deformity from Charcot arthropathy may direct external pressure of the malleoli or talus head against shoes or braces, or skin lesions over a bony prominence. If the ulcer is likely to recur after successful debridement and immobilisation, realignment osteotomy and arthrodesis may be required.¹⁷ Amputation is another option. Refractory heel ulcers may respond well to partial calcaneotomy if the vascular and nutritional parameters reflect adequate healing potential,¹⁹ but full-time use of an ankle foot orthosis is required because the posterior calcaneal tuberosity and Achilles tendon insertion are ablated.¹⁸ The quality of the results after a partial foot (transmetatarsal, Lisfranc, or Chopart) amputation is not necessarily related directly to the length of the stump.²⁰ Factors that contribute to successful partial foot amputation include the presence of normal, healthy, full thickness skin covering the stump and mobility of remaining joints.¹⁹

CONCLUSION

Patients must always be advised that the contralateral extremity is also at risk and the systemic nature of the disease requires careful compliance with medical intervention. Ulcer healing is heavily influenced by the quality of the provided care and the adherence to it by the patients. Increased inflammation and skin expression of MMP-9, PTP1B, and serum growth factors were the main factors associated with failure to heal DFUs. Targeting these factors may prove helpful in the management of DFUs

REFERENCES

1. Reiber GE. The epidemiology of diabetic foot problems. *Diabet Med* 1996; 13 Suppl 1: S6- 11.
2. Khanolkar MP, Bain SC and Stephens JW. The diabetic foot. *QJM* 2008; 101: 685-695.
3. Cavanagh PR, Lipsky BA, Bradbury AW and Botek G. Treatment for diabetic foot ulcers. *Lancet* 2005; 366: 1725-1735
4. Brodsky JW. The diabetic foot. In: Coughlin MJ, Mann RA, eds. *Surgery of the Foot and Ankle*. St Louis, MO: Mosby; 1999:895–69.

5. Wagner FW Jr. Management and treatment program for diabetic, neuropathic, and dysvascular foot problems. In: Instructional Course Lectures: Vol. 28. St Louis, MO: The American Academy of Orthopaedic Surgeons. 1979.p.143–65.
6. Frykberg RG. Diabetic foot ulcers: current concepts. *J Foot Ankle Surg* 1998;37:440-6.
7. Frykberg RG, Armstrong DG, Giurini J, Edwards A, Kravette M, Kravitz S, et al. Diabetic foot disorders: a clinical practice guideline. American College of Foot and Ankle Surgeons. *J Foot Ankle Surg* 2000;39(5 suppl):S1-60.
8. Reiber GE, Boyko EJ, Smith DG. Lower extremity foot ulcers and amputations in diabetes. In: National Diabetes Data Group (U.S.). *Diabetes in America*. 2nd ed. Bethesda, MD: National Institute of Diabetes and Digestive and Kidney Diseases; 1995.p. 95–1468.
9. Levin ME. Classification of diabetic foot wounds. *Diabetes Care* 1998;21:681.
10. Lipsky BA, Sheehan P, Armstrong DG, Tice AD, Polis AB, Abramson MA. Clinical predictors of treatment failure for diabetic foot infections: data from a perspective trial. *Int Wound J* 2007;4:30–8.
11. Ali SM, Basit A, Sheikh T, Mumtaz S, Hydrie MZ. Diabetic foot ulcer-A prospective study. *J Pak Med Assoc* 2001;51:78–81.
12. Rooh UM, Ahmed M, Griffin S. Evaluation and management of diabetic foot according to Wagner's classification. A study of 100cases. *J Ayub Med Coll Abbottabad* 2003;15(3):39–42.
13. FaizurRehman, Nadir S. Diabetic Foot. *J Postgrad Med Inst* 2004;18:463–9.
14. Armstrong DG, Lavery LA. Diabetic foot ulcers: prevention, diagnosis and classification. *Am Fam Physician* 1998;57:1325–32.
15. Andersen CA, Roukis TS. The diabetic foot. *SurgClin North Am* 2007;57:1149–77.
16. Al-Maskari F, El-Sadig M. Prevalence of risk factors for diabetic foot complications. *BMC FamPract* 2007;8:59.
17. Johnson, JE: Operative treatment of neuropathic arthropathy of the foot and ankle. *J Bone Joint Surg* 1998;80-A:1700–9.
18. Smith DG, Stuck RM, Ketner L, Sage RM, Pinzur MS. Partial calcaneotomy for the treatment of large ulcerations of the heel and calcaneal osteomyelitis. *J Bone Joint Surg* 1992;74-A:571–6.
19. Harris WR, Silverstein EA. Partial amputations of the foot: a follow-up study. *Can J Surg* 1964;7:6–11.